

this disease the tongue will be flat, flabby, and coated; the liver and spleen will be enlarged; the hæmoglobin percentage will be about seventy or lower; the temperature is likely at some time to fall precipitously without any hemorrhagic symptoms; the pulse is sure to rise with the following access of fever; the malarial parasites will be found in the blood. We should remember also that a yellow-fever patient with the high temperatures that are likely to prevail in malaria, is a very sick man, whereas the malarial patient is less seriously affected.

In hæmoglobinuric fever the black water itself is very strong evidence against yellow fever, especially if we can prove the absence of red blood cells in the urine. The attack usually comes on after repeated paroxysms of intermittent fever with a severe chill, and the hæmoglobinuria and the jaundice, the enlargement and tenderness of the liver and spleen, with anæmia and low percentages of hæmoglobin in the blood, are prominent features from the start.

*Malignant Jaundice.*—Writers who were not familiar with yellow fever have supposed that there must be a marked resemblance between these affections, but this is not true. In acute yellow atrophy we have the following distinctive features: frequency of the disease in connection with pregnancy, prodromal gastro-hepatic disturbances, early development, and progressive character of the jaundice, absence of the sudden onset with fever and congestive symptoms, diminution in the size of the liver, change in the color of the feces, presence of leucin and tyrosin in the urine, marked diminution of the amount of urea, great prostration, pallor, low percentage of hæmoglobin, and slight œdema.

In Weil's disease the history of the onset corresponds with that of yellow fever, but the gastro-hepatic symptoms are more pronounced from the beginning. The jaundice is more intense and presents a more greenish tint. There is a tendency to diarrhœa; the feces are often clay-colored. The liver and spleen are large and tender. The muscular masses are sensitive to pressure. The hemorrhages, when present, are a later manifestation than in yellow fever. The duration of the disease is longer, its course being frequently marked by two distinct paroxysms. The patient falls very soon into a typhoid state, and finally the urine, according to some authorities, is apt to contain the Proteus flavescens.

*Prognosis.*—Attention has already been given to the prognostic significance of the several symptoms; hence it is not necessary to dwell extensively upon this subject. We may summarize the unfavorable prognostic signs as follows: maintenance of the temperature at a high level for several days; high temperatures coinciding with the appearance of the jaundice and hemorrhages; persistent vomiting after the initial emptying of the stomach; noticeable falls of the temperature after vomiting, with subsequent elevation; marked reduction of the arterial blood pressure; early development of pronounced jaundice, albuminuria, or gastric hemorrhage; loss of consciousness with active delirium or with a staring expression; profound coma; suppression of urine.

The mortality from yellow fever varies in the different epidemics. The series of 277 cases treated at Las Animas Hospital in Havana, which have been specially analyzed in this paper, gave a mortality of 22.7 per cent.

I have myself seen the range of mortality vary, in different epidemics, between 4 and 36 per cent. Among soldiers confined in barracks the mortality is said to have been as high as 92 per cent. It is low among children and very low in the full-blooded negro. I have not been able to find any decided differences in the mortality of the whites from the various nations. Reports to the contrary are, in my opinion, to be explained by accidental conditions affecting at the time one race more than another. The natives of one country, for instance, will be better looked after; they will come in for treatment earlier than others. At Las Animas Hospital the mortality among those who were admitted within the first forty-eight hours of the disease was 17.7 per cent., while among those who were admitted later it rose to 32.3 per

cent. Now, the first were mostly Americans; the second were Spaniards, Italians, etc.

Before concluding this description of yellow fever I wish to state that though I have made special use of the material at my disposal, which is derived from the study of cases in Havana during 1900 and 1901, my knowledge of the disease is based upon the study of many epidemics observed in the United States, in Cuba, and in Mexico. I mention this because I wish to declare that I have found the disease everywhere and at all times to be always the same. The number of mild cases will be greater at one time than at others. There may be a difference in intensity; but, aside from this, I have never been able to discover characteristic features that would distinguish one epidemic from another.

*MORBID ANATOMY.\**—External appearance of the body. The cadaver of yellow-fever patients presents a characteristic coloration. The shade of yellow is variable up to a deep saffron color. This is not uniformly distributed as in other forms of jaundice, but rather appears with greater intensity in the depending portions of the body. At the same time we find extensive areas of cadaveric lividity due to hypostasis. The face appears livid and turgid. From the mouth and nostrils we generally find oozing a dark fluid, or dark crusts or coagula are found about these orifices. The conjunctivæ are yellow and often ecchymotic.

*The Heart.*—This organ is not as a rule seriously affected in yellow fever. This opinion does not conform with that of Soudré and Couto as expressed in Nothnagel's "System of Medicine." The size and weight of the organ are normal. The consistence is generally firm, with few exceptions. The external aspect indicates in some cases a slight increase of the subpericardial fat, specially toward the base, and along the transverse and longitudinal furrows. This is not an evidence of degeneration since the underlying muscular tissue is generally found to be normal. On the surface we may find a few ecchymotic spots, but they are not more numerous than those found elsewhere. Soudré and Couto describe in one case a hemorrhagic focus about the size of an almond, involving the whole thickness of the left ventricular wall. On opening the heart the muscle appears somewhat paler than normal, and the thickness of the ventricular wall is normal, or may be slightly increased. This is described as constant by Couto and Soudré. The left auricle and the right side present nothing abnormal. Some post-mortem clots are generally found in the cavities. The endocardium presents to the naked eye, in some cases, a yellowish discoloration, more marked toward the tendinous extremities of the papillary muscles. Ecchymotic points may be seen generally near the large vessels. These are not constant changes. The valves may be slightly thickened toward the borders, but usually they are normal. The valvular thickening and vegetative endocardial lesions described by Couto and Soudré as constant, we have not been able to find.

*Histology.*—Alterations of the muscular fibre occur only in rare cases. The striation, which is never as distinct in the cardiac as in the voluntary muscles, shows quite clearly in most of our preparations as soon as we apply the sufficient amplification. The continuity of the fibre is not altered, and it is well known that in the degenerated heart this is easily broken. The nuclei take the stains readily, and do not present the deformities and elongations that are found in other infections. The interstitial connective tissue is not increased or proliferated. The vessels show no alterations. Occasionally we find small extravasations near the endo- or pericardium. The subpericardial fat appears to be somewhat increased. This probably explains the augmentation in the size of the organ. Rarely we have met with alterations in the muscular fibre. These are by no means uniform. More or less granular cells are found among perfectly normal ones. The former are slightly vacuolated, and their stri-

\* This section has been written by Drs. Juan Guiteras and A. A. Aball.—EDITOR.

ations may be completely lost. The nuclei will be found to take the stains, and to show no profound alterations. The fatty degeneration, described by others, we find to be exceptional. Nowhere have we found evidences of acute endocarditis. In one case we found a minute accumulation of round cells, separating muscular fibres which were perfectly normal.

The pleura and lungs present no lesions that are characteristic of yellow fever.

*The Spleen.*—Its size is usually not altered. On section the pulp presents a dark wine color, with reddish areas. The Malpighian corpuscles are not prominent. The consistence of the organ is somewhat diminished. Histologically we find the organ but slightly affected. The Malpighian bodies show neither proliferative nor degenerative lesions, but the connective-tissue stroma appears to be slightly increased. The parenchyma of the organ is congested. The small veins are particularly distended. In some cases we met with hemorrhagic foci. There is no increase in the amount of pigment contained in the spleen. Some authors describe cloudy swelling limited to small areas of the parenchyma. This we have not been able to confirm, nor have we found any appreciable change in the vascular walls.

*The Kidneys.*—By the naked eye we discover profound lesions that appear to be constant. The size is more or less increased. The color is generally yellowish-red. Upon section the color appears reddish-yellow or grayish. The vessels are dilated and the blood flows freely. The medullary zone contrasts with the cortical through the normal or somewhat cyanotic hue of the former. The capsule peels easily, and the surface appears reddish-yellow with vascular arborizations.

*Morbid Histology.*—Two kinds of lesions are found in our preparations: one is constant and the other variable. The glomeruli, though sometimes normal, present in most instances evident lesions. At times the capsule is thickened through proliferation of its cells, but it is more frequently normal, except that the epithelium, parietal or visceral, is more or less degenerated. The cavity is generally filled with an exudate of variable character. It may be granular, containing exfoliated cells, or it may present minute fatty areas or evidences of hyaline degeneration. The exudate takes a rose color with the hæmatoxylin-eosin stain, or gives the reactions of hyaline matter. The capsular degeneration does not appear to be constant; nor is it necessarily fatty, even in cases in which the fatty change is quite apparent in other portions of the kidney. The glomerule is retracted and small in proportion to the amount of exudate, and it rarely shows evidences of cloudy swelling. In our experience the more constant lesions are found in the convoluted tubules. Their lumen may be dilated, and contains granular matter from the disintegration of cells and from the coagulation of albumin. Together with this material we find cells in a more or less degenerated state, and fragments of the same, in conjunction with deformed free nuclei, still capable of taking the basic stains. In some places we find hyaline masses, true casts, filling the lumen. In preparations stained after Marchi, Golgi, or Weigert we find here and there fine fatty granules or droplets of varying size. This is by no means always the case, for we find many tubules in an advanced state of degeneration without signs of the fatty reactions. We have not been able to find the colloid bodies and crystals described by Councilman. The epithelial lining of the convoluted tubules is intensely degenerated, in the shape of cloudy swelling or fatty change. Osmic-acid preparations, stained by safranin and carmine, will show cells infiltrated with fat, and still presenting complete integrity of the nucleus. Mitotic figures are rare. We find also the special form of necrosis described by Councilman, namely, minute, rounded, or irregular bodies, well differentiated from the protoplasm. They stain intensely with eosin, and should be studied with high powers. The straight collecting tubes, the descending loop of Henle, the excretory ducts are less affected. Here the integrity of the epithelium is

better preserved, and the form of degeneration most frequently encountered is the cloudy swelling. The tubes in the pyramids are often obstructed with cylinders corresponding with those that are found in the urine. The interstitial connective tissue also participates in the process. We find recent round-cell infiltrations around the glomerules (periglomerulitis), and about the cortical and medullary tubules. In some sections the infiltration is such as to invade the tubules themselves. The epithelial cells are found degenerated and compressed among connective-tissue cells of new formation and leucocytes.

Twice we have met with small abscesses of the kidney at the line of contact of cortical and medullary portions. Bearing upon the question of secondary infections we should state that one of these cases was of short duration.

The renal vessels are at times dilated, especially the larger ones, the interlobular and arciform; but no appreciable changes are found in the walls of these or of the smallest vessels. Hemorrhages are rarely met with.

We may classify the renal process in yellow fever as a hæmatogenous acute parenchymatous nephritis.

*The Stomach.*—The size of the organ is normal or slightly increased. On opening the viscus we find always more or less of a dark fluid, resembling coffee infusions of variable density. Frequently we find remnants of food, and at times fine shreds of mucous membrane. The spectroscopic, chemical, and microscopic investigations show that the coloring matter of this fluid is hæmoglobin or some one of its derivatives. The mucous membrane presents a reddish-gray color and ecchymotic points especially about the cardia and pylorus. The remainder of the surface presents also reddish points corresponding with the dilated vessels.

*Histology.*—The changes found vary in different cases. Sometimes they are limited, in the mucosa, to a simple congestion, specially characterized by a distention of the intertubular vessels that empty into the veins of the submucosa. In these cases only the superficial part of the mucosa is altered. The nucleus and the protoplasm do not take the stain well, but the epithelium is generally preserved. Such losses of it as may be encountered are to be ascribed to cadaveric changes. We find in these stomachs small superficial hemorrhagic foci, and at times small extravasations, but without any evidence that the capillaries have suffered in their integrity. Over the places just described the more superficial layers of the epithelium are degenerated, and the cells are found mixed in a magma composed of exfoliated cells, altered red globules, and free pigment. Other cases present deeper lesions. These are more pronounced toward the fundus and pylorus, especially the former. The chief or central cells of the glands present lesions that are characterized by lack of affinity with the hæmatoxylin, and a granular condition of the protoplasm; but we have not been able to demonstrate the presence of fat. These alterations do not generally affect uniformly the whole length of the gland. In the glandulæ propriae of Kölliker we find normal chief cells alongside others more or less degenerated. The fundus of the gland is generally less affected than the periphery. In these cases the interstitial connective tissue participates in the degenerative process. This tissue presents a certain degree of translucency, and a lack of definition of its elements. These alterations are more manifest in the superficial layers. These do not stain distinctly with the eosin or with the fuchsin in van Gieson's process. The elastic fibres cannot be easily distinguished. We have seen no evidence of active connective-tissue proliferation, such as is found in most of the forms of gastritis, specially the hemorrhagic. We do find accumulations of round cells in the mucosa and submucosa, but without evidences of degeneration or active proliferation. The submucosa presents small areas of degeneration in the muscularis mucosæ. We have not been able to discover the punctated appearance described by Couto and Soudré. The vessels are often dilated, but no alterations can be found in their walls. The lumen is generally packed with red cells and a few leucocytes. In one case connective-tissue



elements of new formation were found infiltrating the sub-mucosa about the veins, but even here no change could be demonstrated in the vascular wall. The muscular coat is normal in volume and shows no signs of degeneration. Distended vessels are seen among the layers of the musculature. The fat of the subserosa is not increased, nor is this membrane in any way altered.

**The Intestines.**—The lesions vary with the form and intensity of the infection. In those cases in which there have been intestinal hemorrhages the lesions are more intense. Invaginations of the small intestines have been met with. In one of our cases there were two such dislocations: one, at 1.5 metre from the duodenum, and the other 30 cm. lower down. There were no adhesions nor inflammatory exudate upon the serosa, but simply a congestion of the invaginated portion of the intestine.

On opening the intestine we find the color to be normal, except at some places where a reddish and cyanotic discoloration is apparent. This is more marked in the upper part of the intestine. Peyer's patches are not swollen or ulcerated. Histologically we find no serious lesions of the mucosa. It is less congested than that of the stomach. In most of our preparations there are marked cadaveric lesions, specially toward the duodenum. The epithelium covering the villi may be wanting or macerated, but it is generally present. The glands of Lieberkühn show no evidences of catarrhal inflammation, and the cells of the glands of Brunner present nothing abnormal. We find no abnormal round-cell or leucocytic infiltration. In hemorrhagic cases we find foci similar to those described in the stomach. The sub-mucosa and the serosa are normal.

The large intestines are usually not affected. When we meet with lesions they are generally encountered in the lower portions of the gut and are catarrhal in character. The rectum generally contains fecal matter, the consistence of which varies considerably. Hemorrhagic lesions are occasionally met with.

**The Liver.**—The volume of the organ is normal or slightly augmented. In 60 autopsies performed by Couto and Soudré the weight averaged 1,680 gm. The minimum was 1,200 and the maximum 2,200 gm. In 8 cases it varied between 1,400 and 1,500. Thirteen cases, investigated by Dr. Araujo Vianna, gave a specific weight as follows:

Absolute weight.	Specific weight.	Weight of the fat extracted by ether.	Absolute weight.	Specific weight.	Weight of the fat extracted by ether.
1900	1.045	226	1575	1.054	283
1610	1.037	236	1200	1.048	192
1500	1.079	185	1650	1.058	203
1750	1.071	233	1760	1.037	369
1915	1.052	204	1400	1.083	56
1770	1.022	306	1450	1.085	43
1800	1.028	420			

**Color.**—The color of the organ is characteristic of the disease. It may be compared with new leather or box-wood. Minute reddish points are generally found on the inferior surface. On section we observe the same discoloration, and we notice some reddish-gray points corresponding to portal spaces. The gall bladder usually contains small quantities of bile of dark color and syrupy consistence. The biliary passages are patulous, and on compression of the gall bladder the bile flows freely into the duodenum.

**Histology.**—From the study of our cases we conclude that the liver is the organ most seriously affected in yellow fever. We are at once struck by the deformity and disorder that prevail in the hepatic lobule. The cells are not radially distributed around the central vein, and the vascular net appears more tortuous than normally. Foreign elements, such as leucocytes and connective tissue of new formation, among the hepatic cells, give rise to this disorder. The protoplasm of the cells is more granular than normally, and presents vacuoles of vary-

ing size. These gradually gain upon the protoplasm until they invade it totally. Highly refractive hyaline bodies, more or less rounded generally, but at times presenting slight prolongations, are found in the cells and between them. These bodies take the eosin stain intensely, and take an orange color by the van Gieson method. According to Councilman they represent a partial necrosis that is characteristic of the acute fatty degenerations of the liver. ("Report of the Etiology and Prevention of Yellow Fever," by George M. Sternberg. "Report of the United States Marine Hospital Service," 1890.) The nucleus, usually excentric, generally stains well with the basic colors. This integrity of the nucleus contrasts in a remarkable manner with the disintegration of the protoplasm, and probably explains the rapid recuperation of the functional activity. Some nuclei are degenerated, as evidenced by signs of caryorrhexis and vacuolization. This occurs especially in the neighborhood of the portal spaces. Here also we meet occasionally with evidences of proliferation: double nuclei, various manifestations of mitosis, and small hepatic cells. In preparations colored by the Marchi method, or fixed in Flemming's fluid, we find that the vacuolizations of the protoplasm represent simply fat globules. These take the black color with the osmic acid. Their number varies from two to four, or they may run together, occupying the whole body of the cell. We rarely find necrotic areas. In one case the necrotic areas were confined to the periphery of the lobule, while the central portion, charged with fat, presented a normal coloration of the nuclei.

The interstitial connective tissue participates actively in the pathologic process. This is especially true in the portal spaces, where we encounter accumulations of round cells gathered around the blood-vessels and bile-ducts, and frequently pressing upon the latter and obliterating their lumen. This obliteration is not constant, for we meet with open ducts even in the midst of the proliferated connective tissue. In the interior of the acini we find also a considerable number of round and fusiform cells, together with fibrillae of connective tissue and a few leucocytes.

It is a remarkable fact that we meet nowhere with evidences of a decided pigmentation of the organ. The free pigment is relatively scarce. It is manifested by a finely punctated appearance, and does not give the iron reactions. Pigment is also found within the cells. The scantiness of pigment in the yellow-fever liver is in strong contrast with the findings in other forms of jaundice. The walls of the biliary passages are normal.

The blood-vessels of the liver present no alteration of the walls. Their lumen is not distended, and in their contents we find but rarely an increase of the leucocytes. Hemorrhages are very rare.

**The Pancreas.**—In the few cases in which we have studied this gland we have found only cadaveric changes. We could not demonstrate the existence of the fatty degeneration described by some observers.

**The Nervous System.**—The meninges are generally in a normal condition. Sometimes ecchymotic spots are found in the dura. The sinuses are generally found filled with blood in those individuals who die in a comatose state. The arachnoid, the pia, and the choroid plexus are congested, and occasionally we meet with small extravasations. On section the blood flows somewhat freely from the vessels. The ventricles are dilated. Their walls, as well as the cerebro-spinal fluid, are slightly stained yellow. The brain is of normal consistence, but somewhat softened in prolonged cases. On section the color is normal and the punctated appearance is rather prominent. The spinal cord presents similar appearances with less prominence of congestive signs. The histology of the nervous system has not been carefully investigated.

**TREATMENT.**—The mortality statistics, referred to under the head of Prognosis (and they correspond with others from various sources) show the importance of early treatment in yellow fever. Not that we possess any specific that should be applied during the first hours of the disease, but that those patients are more likely to recover

who are put to bed at once, and who are kept on an absolute diet. Nothing else, if we except the administration of a laxative and the employment of some palliative measures, was done for the patients admitted to Las Animas and the Mercedes hospitals during the first two days of the disease. The results compare very favorably with those obtained without the proper sick-room discipline, and with active medication. I recommend in this connection the reading of a paper entitled "Notes on the Treatment of Yellow Fever at Las Animas Hospital," by Col. W. C. Gorgas, in the *Journal of the Association of Military Surgeons*, for October, 1903.

The patient should be put to bed at once and kept in the horizontal position. Clean linen for the bed and person should be furnished plentifully. Windows and doors should be left open (screened against mosquitoes, of course), care being taken to avoid only the direct action of strong currents of air. The quarters should be as clean as possible. Patients seem to do well when treated in tents, whereas the mortality is generally high in old yellow-fever hospitals. The skin should be cleansed and rubbed with hot water and soap, and clean, loose garments should be substituted for the clothing worn by the patient. It is not unreasonable to believe that these measures may lessen the chances of secondary infections. At any rate, the patients so treated do better than others.

A mild purgative—calomel and jalap or castor oil—is ordered, and water is given freely through a drinking tube or feeding cup. From fifty to eighty ounces of fluid are given in the twenty-four hours. Plain water, pleasant alkaline waters, ginger ale, lemonade, orange leaf tea, are given, preferably cold, though some patients call for warm drinks. Weak solutions of bicarbonate of sodium may take the place of mineral waters. The patient is not allowed to sit up to empty the bladder and rectum.

Absolutely no drugs are given until we see clear indications for them, a condition that is not likely to arise in a large number of cases, or only from the third day onward in the grave cases. During this interval much can be done to relieve the sufferings of the patient and to gain his confidence.

External applications should be freely used: light snapisms to the back of the neck, to the calves of the legs, to the loins, or to the epigastrium; ice caps to the head or to the back of the neck; rubbing of the legs or back with alcohol or some liniment; warm applications over the bladder if there be retention of urine; sedative water to the forehead. If the body-temperature be very high the surface should be sponged with cool water and alcohol, or an enema of cold water may be given.

If by night time the patient be suffering much from pains in the back and head, a dose of five grains of phenacetin may be given, and repeated, if necessary, once during the night. After the third night this drug is scarcely called for, and its use is probably harmful.

The first symptom that is likely to call for special treatment is vomiting. If the bowels have not acted since the initial purge we should now give a Seidlitz powder in broken doses, or effervescent magnesia, or calomel in minute, often repeated doses. If the vomiting does not stop readily, we should discontinue the administration of liquids by the mouth, and allow nothing but cracked ice in small quantities. At the same time rectal injections of warm physiologic salt solution in doses of six ounces every four hours should be prescribed. It is to be hoped now that the rectum has not been made irritable by the excessive use of purgatives, for much depends upon the continued administration of these injections perhaps for several days. When we have reached the fifth or sixth day of the disease, the question of feeding these patients presents itself. If there has been no vomiting one ounce of milk may be given every two hours by the mouth; but if we have been forced to use the rectal injections, two or three ounces of milk should be injected with the salt solution.

If the vomiting and retching be very frequent, a few doses of cocaine in tablet form should be tried, or ice

may be applied to the throat. The oft-repeated vomiting is almost sure to lead to hemorrhage. Immediately upon the first appearance of brown flakes in the vomitus I prescribe tincture of the chloride of iron in five-drop doses every two hours. I give it usually with a little glycerin and lemon juice. The iron almost always reduces the frequency of the vomiting. I have tried adrenal extracts without success. If there be much hemorrhage from the mouth I prefer to use a mouth wash containing antipyrin. Wherever the source of the hemorrhage may be, I think the iron should be insisted upon.

The remainder of the treatment reduces itself to sustaining the strength of the patient, and stimulating the action of the heart and kidneys by the judicious use of strychnine and digitalis and alcohol; the two former by the hypodermic method, and the latter by the mouth or rectum. Alcohol is not well borne in large doses; a tablespoonful of champagne or some whiskey in carbonic-acid water, given occasionally when symptoms of collapse appear, is without doubt useful. Hypodermics of strychnine, or of digitalin in doses of gr.  $\frac{1}{10}$  or gr.  $\frac{1}{15}$  may be given every six hours with advantage. I do not believe these patients will stand as much strychnine as those suffering from other infectious diseases.

Digitalis is more specially indicated when the kidneys are inactive. In suppression of urine cold-water rectal injections have been recommended, and in some few cases I think I have done good through the diuretic action of calomel.

The prolonged typhoid cases, generally marked by intense jaundice, require alcohol and strychnine. Most of them have to take iron for a few days on account of the hemorrhages; but, as these subside, I think they are benefited by the use of small doses of chlorate of potassium. Later on, in the period of convalescence, they should take muriatic acid and nux vomica.

As already mentioned, about the fifth day we should begin to give milk, with lime water, if necessary. The dose should be gradually increased, and about the ninth day a mild solid diet may be ordered. Ice cream is much relished, and may be given before this.

The patient should be allowed to get on his feet gradually, and in the majority of cases he is up and about at the end of the second week. Very mild cases will have recovered completely in ten days, while others will require the use of peptonized food, tonics, and massage for a few days.

**PROPHYLAXIS.**—The perfect success of the prophylactic measures against yellow fever is based on the complete knowledge we now possess of the mode of propagation of the disease. It is transmitted by the *Stegomyia fasciata*; the insect becomes infected by biting the yellow-fever patient at any time during the first three days of the disease; the insect becomes infecting twelve days after it has bitten the yellow-fever patient. The application of this knowledge to prophylactic practice is perfectly feasible.

The patient should be treated, if possible, within an enclosure known to be free from the *Stegomyia* mosquito. In cities exposed to the introduction of yellow fever there should be kept always in readiness such an enclosure—a mosquito-proof ward. In the city of Havana we have no hesitation in receiving cases of yellow fever from the shipping. We have, almost forcibly and with the idea of protecting the ship and the port to which it was bound, removed such a patient from a vessel and brought him into the city. Our security in this city depends simply on our having such an enclosure. The patient is brought under a mosquito bar to the mosquito-proof wards of Las Animas Hospital, where he is cared for by attendants, many of whom are non-immunes. This has been done now for three consecutive summers without a single instance of propagation of the disease.

If the patient must be treated at home steps should be taken to screen the windows and doors. If possible a room should be first fumigated to destroy the mosquitoes, and screened before the patient is brought into the apartment.



It is apparent that the source of infection, the patient, is quite under our control in most instances. Of course the possibility always exists of mild ambulatory cases that may escape our observation. I have always thought that such cases, specially among the negroes, are responsible for the spread of some epidemics.

If the patient has had the opportunity to infect mosquitoes before he comes under observation, it becomes necessary to destroy the infected insects. Here, again, we observe how completely this disease is under our control. The insects give us time to act. They can do no harm before the lapse of twelve days. Furthermore the *Stegomyia* mosquito is a domestic insect. It is not likely to migrate far from the patient. It will remain in the same room or at least in the same house. If the patient's quarters are protected against the smoke, the other parts of the building may be fumigated with pyrethrum. The houses immediately adjoining should be fumigated at the same time. After the recovery or death of the patient the room occupied by him should also be fumigated.

Although the pyrethrum is not so certain an insecticide as are certain other substances, it is more manageable, and can be applied in all places and at all times. If care be taken, during fumigation, to leave a sheet of paper, wet with mucilage, under a glass window, or under some opening pasted over with paper, the insects are sure to fly to the light, and will drop, when paralyzed, upon the paper beneath. In this manner, and by carefully sweeping the room, before freely opening the windows, after fumigating for four hours, we are quite sure of collecting all the mosquitoes. These should be burnt at once, or placed in a bottle, if we desire to determine the kind of insects found in the premises.

The complete success attained in Havana by these methods was in part due to the fact that most of the patients affected with yellow fever were hospital patients; that is, they could be removed at once to Las Animas, or to some of the private hospitals in which the sanitary department had seen to the preparation of adequate wards.

A fine was imposed on the physician who failed to report a case of yellow fever, and a commission of experts,

whose opinion as to the diagnosis was final, visited the patient at once, and reported upon the nature of the disease. Preventive measures already instituted were continued or not according to the finding of the commission.

At the same time that these direct measures of prophylaxis are being carried out, every effort should be made to diminish the number of the *Stegomyia* mosquitoes in the locality. Deposits of water of all kinds should be reduced to a minimum. Waste waters, sinks, and pools should be frequently oiled with petroleum, and water barrels, tanks, and cisterns should be screened.

The above simple method of prophylaxis is based on the well-known studies of Dr. Finlay, and Drs. Reed, Carroll, Lazear, and Agramonte. These authors had left undetermined the duration of the period of infectivity of cases of yellow fever. From their experience and my own it appeared probable that this period of infectivity was limited to the first three days of the disease. In the report of the French commission (Marchoux, Salimbeni, Simond) sent to Rio by the Pasteur Institute, we find (*Annales de l'Institut Pasteur*, November, 1903) that special attention was paid to this point, and that inoculation experiments were made to show that a case of yellow fever on the fourth day was not capable of transmitting the disease.

Other experiments of the said commission are of interest from the point of view of individual prophylaxis, although I do not believe that they are capable of extensive practical application. Our system of general prophylaxis is so complete, the results are so certain, that we can scarcely believe that methods of individual prophylaxis will ever be called for.

The experimenters of the French commission have immunized individuals by injecting serum of yellow-fever patients previously treated by heating for five minutes at a temperature of 55° C., or by keeping it under a layer of vaseline during eight days. Dr. Carroll had already suggested the attenuation of the virus by heat. The commission also show that the serum of convalescents possesses preventive properties, and perhaps curative properties, as suggested by Finlay.

Juan Guiteras.

## GENERAL INDEX.

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